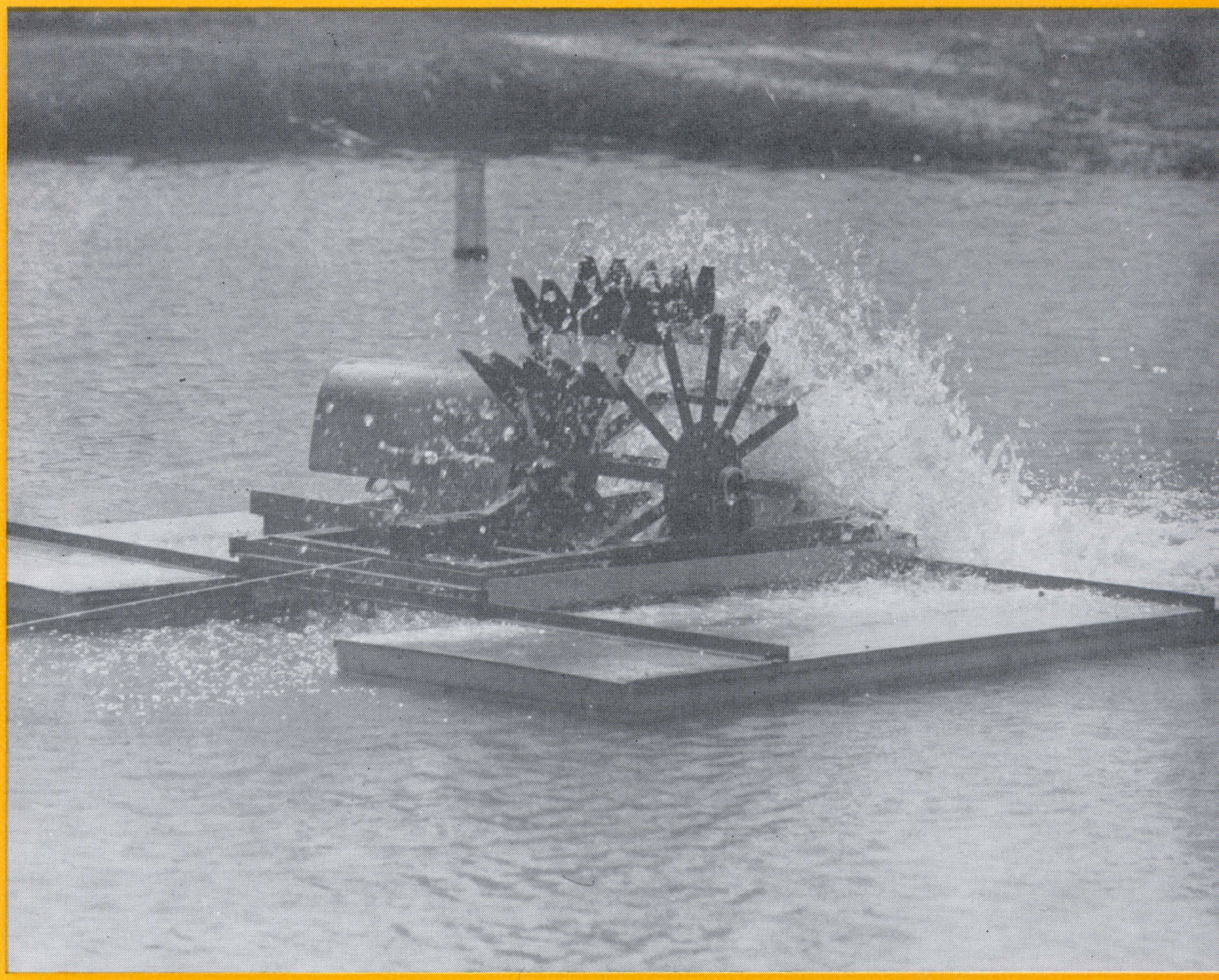


VOL. 22, NO. 2/SUMMER 1975

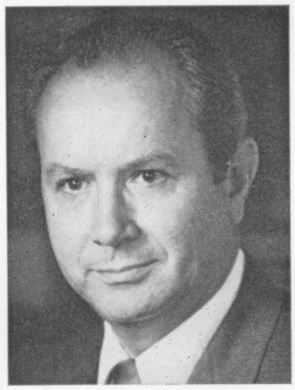
HIGHLIGHTS

of agricultural research

AGRICULTURAL EXPERIMENT STATION/AUBURN UNIVERSITY
R. Dennis Rouse, Director Auburn, Alabama

DIRECTOR'S COMMENTS

WHAT IS THE VALUE of the Agricultural Experiment Station to you? I doubt if anyone can do more than speculate on this question but it is worthy of our thought, especially in 1975 as we endeavor to recognize that state support of this system of research began 100 years ago. Has it accomplished what the drafters of Agricultural Experiment Station legislation anticipated? "To assure agriculture a position in research equal to that of industry which will aid in maintaining an equitable balance between agriculture and other segments of our economy. . . ." By any criteria, it has exceeded anything the drafters of 100 years ago could have imagined. This research, coupled with effective education and the free enterprise system that is uniquely American, has resulted in a standard of living for the people of this Nation that is unequaled in the world either historically or at present. The partnership of publicly financed research and education tied with a privately oriented agriculture is the magic mixture.



R. DENNIS ROUSE

The problems of agriculture are continually changing and never must we think the job is done – it has barely begun. The future, with an ever increasing population and increasing demand for food and fiber, is before us. Agricultural research efforts must be continued and intensified if we are to leave those future generations the legacy that we inherited – a nation and a world in which human beings can enjoy the wonders of a wholesome life.

Many problems whose solutions could have far-reaching effects are problems that to adequately research will require a severalfold increase in the research effort of the agricultural experiment stations. These frontiers of research include such areas as increasing photosynthetic efficiency to more effectively harness the sun's energy, extending and increasing biological nitrogen fixation, utilization of new means of genetic improvement, improved reproductive efficiency, and improved utilization of biological products.

As important as these new frontiers are for the future, equally important is a continuing research effort on old problems. One example is a continuing research effort to cope with the changing biological nature of agriculture. In the fall of 1973, a peanut disease research team from this station observed resistance of the peanut leafspot organism to a fungicide that had been so effective in controlling this fungal disease that in that year 85% of the peanuts in Alabama were treated with the fungicide. They confirmed the resistance in the laboratory and alerted the manufacturers and scientists in other states in the fall of 1973. The alertness of these scientists enabled the manufacturer to begin a search for means to overcome the resistance and at the same time other manufacturers of effective fungicides were able to increase their productive capacity to prepare for the 1974 demand. Our 1974 research at the Wiregrass Substation showed that yields from plots treated with effective fungicides were 60% greater than from plots treated with the fungicide to which resistance had developed, resulting in a significant difference in income. This research effort and the proper handling of the information resulted in a net of at least $7.5 million just to the peanut growers in Alabama, but severalfold this amount to the citizens of the State and to the growers and citizens of neighboring peanut producing states.

Agricultural Experiment Station research must be continuous and ever vigilant for the problems of producers and for the needs of the consumers.

may we introduce . . .

Dr. Stanley P. Wilson, recently appointed associate director of the Agricultural Experiment Station and assistant dean of the School of Agriculture.

Dr. Wilson was born in Escambia County and grew up on a farm, which his father still operates there. He earned a B.S. degree in animal husbandry and an M.S. in animal breeding from Auburn. After earning a Ph.D. from Oklahoma State University he was accepted as a post doctoral scholar at the National Academy of Sciences. While at Auburn, Dr. Wilson was a member of Gamma Sigma Delta and Sigma Xi honoraries, the Ag Club, and the Ag Council. He is also listed in Who's Who in the Midwest, American Men in Science, and the Dictionary of International Biography.

Following his two-year post-doctoral studies, Dr. Wilson began a 12-year career with the U.S. Department of Agriculture's Agricultural Research Service. He served as Coordinator of the North Carolina Regional Poultry Broiler Lab, then as National Leader for Poultry Genetics. In 1967, he was promoted to Director of the Pioneering Research Laboratory. Since 1972, he has served as Research Leader for the Agricultural Research Service at Purdue University.

HIGHLIGHTS of Agricultural Research

SUMMER 1975 VOL. 22, NO. 2

A quarterly report of research published by the Agricultural Experiment Station of Auburn University, Auburn, Alabama.

ON THE COVER. Catfish pond aeration done by ¼ hp. electric motor is illustrated. **See story on page 3.**

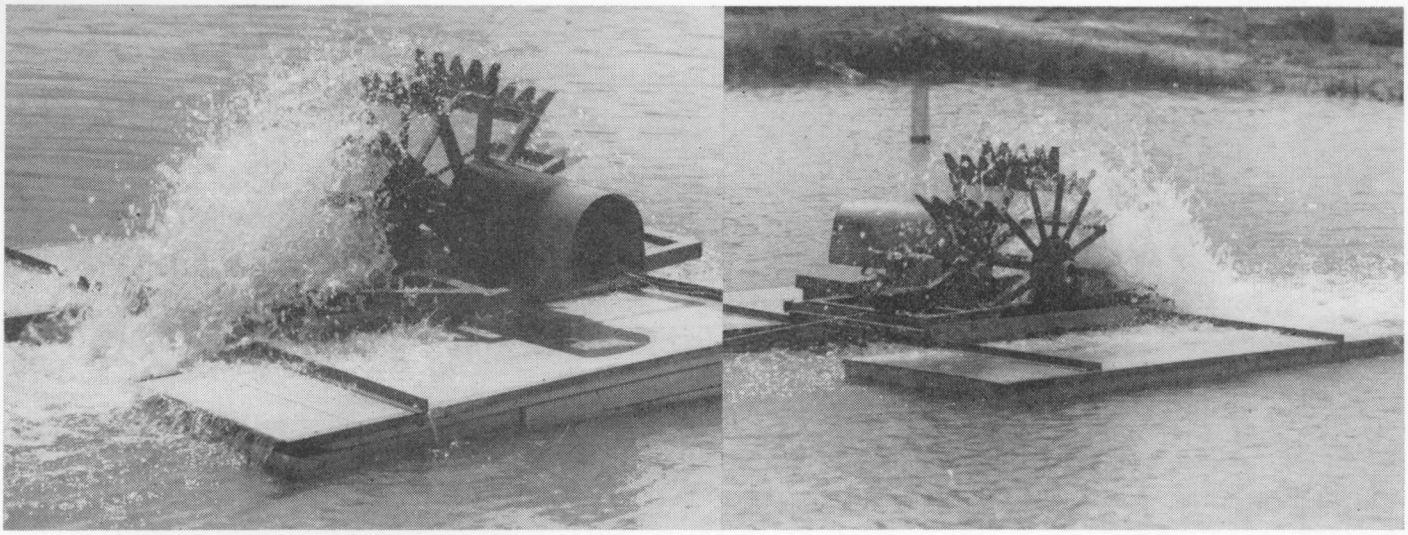


FIG. 2. Motor and paddlewheel sides of catfish pond aerator used to aerate experimental catfish ponds at Auburn.

Paddlewheels For Catfish Pond Aeration

C. D. BUSCH and J. L. KOON
Department of Agricultural Engineering

COMBINATION OF WARM WEATHER and cloudy days in late summer can result in low oxygen levels for fed catfish ponds. The critical period is likely to be just after sunrise (as shown in Figure 1) when overnight demands have depleted the oxygen storage in the water and resupply by photosynthesis has not been activated. When oxygen levels drop below 3 parts per million (p.p.m.) catfish will usually not feed with enthusiasm. Oxygen levels below 1 p.p.m. are likely to lead to fish kills.

Test Aerator

Several types of mechanical aerators are being used to maintain an adequate dissolved oxygen level in catfish ponds. These include air blowers, submerged pumps and propellers. New among those being developed and tested at the Agricultural Experiment Station is a paddlewheel powered by a ¼ hp. electric motor (Figure 2). The paddlewheel has its ancestory in riverboat propulsion and present day use in the treatment of domestic sewage and livestock wastes. Reduced in size, it is now showing promise as an energy saver when used to maintain oxygen levels for catfish ponds.

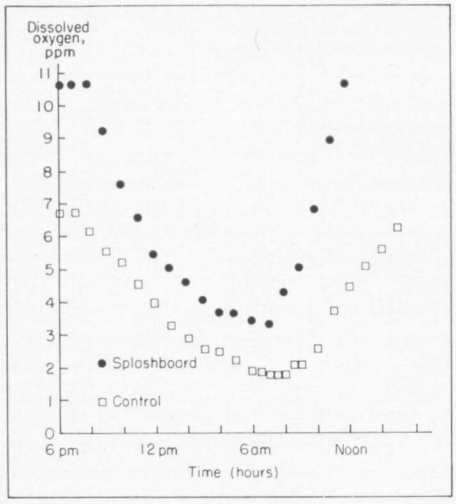


FIG. 1. Typical dissolved oxygen pattern.

Auburn Tests

In tests at the Auburn Fisheries Research Unit a comparison between the paddlewheel and a pump circulation biofilter unit gave the oxygen profiles shown in Figure 3. The paddlewheel maintained the oxygen level above 5 p.p.m. while the biofilter treatment allowed it to dip below 1 p.p.m.

In another experiment the paddlewheel is being compared with a ⅓ hp. propeller type of fountain aerator. The table gives the 1974 results from four 1/10-acre ponds each stocked with 800 channel catfish. The aeration equipment operated 12 hours each night and approximately 20% of the daylight hours from July through September.

CATFISH PRODUCTION ON 0.1-ACRE PONDS UNDER PROPELLER AND PADDLEWHEEL AERATION, MAY-OCTOBER, 1974

Treatment	Pond No.	Power use	Gain
		Kilowatt-hr.	*Lb.*
Paddlewheel Aerator	15	472	468
	16	513	503
Propeller Aerator	13	947	453
	17	1145	487
	18	1148	476

Results

For an average power cost of $0.04 per kilowatt hour, the cost of paddlewheel aeration would be $0.04 per lb. of gain while the propeller-type aerator would cost $0.09 per lb. Additional tests are being conducted to evaluate the paddlewheel's effectiveness on commercial production sized ponds.

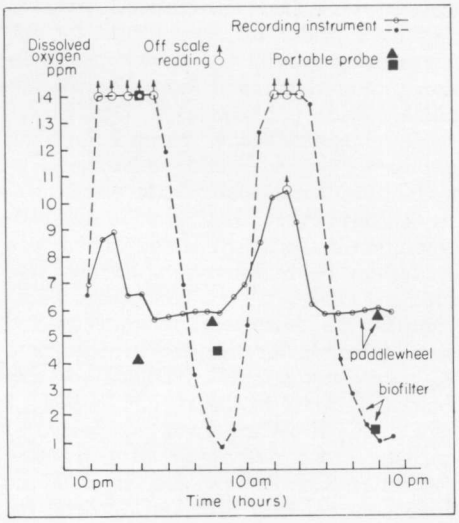
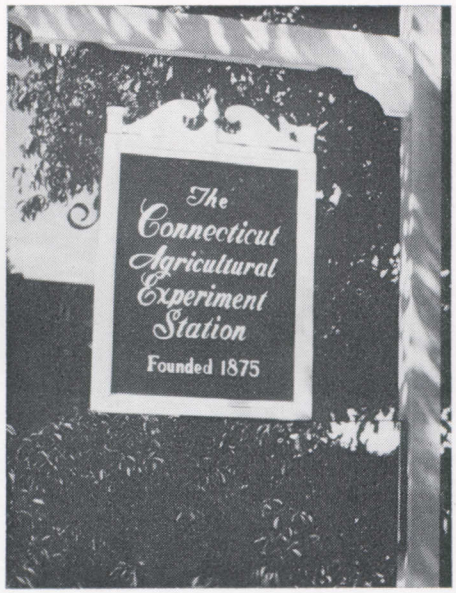


FIG. 3. Paddlewheel and biofilter dissolved oxygen profiles.

FOUNDING OF THE FEDERAL AGRICULTURAL EXPERIMENT STATION SYSTEM

ROY ROBERSON
Department of Research Information



EDITORS NOTE: This is the first of a three-part series, to be published in *Highlights*, relating the historical development of the Agricultural Experiment Station at Auburn. Part two, "The Founding and Development of the Auburn Experiment Station," will appear in the Fall issue.

FROM A SLIVER of suspicion and dogged determination of a young chemist in Connecticut a hundred years ago, sprang the world's largest agricultural research organization – The Agricultural Experiment Station System –with over 10,000 scientists in 50 states, Guam, Puerto Rico, and the Virgin Islands.

It began with Samuel Jonnson, a New York born chemist who had studied at Yale and in Germany. He returned to New Haven, Connecticut and Yale University as a professor of analytical chemistry in 1855. Johnson took an active part in agriculture and became a proponent of what science could do to help farming. At a meeting of the New York Agricultural Society in 1856, he lectured on the problem that farmers in the northeastern U.S. had encountered concerning high prices for fertilizer that often consisted primarily of harbor mud. Johnson proposed a monthly analysis of fertilizers with publication of the results, which he said would compel fertilizer producers to be "honest and careful."

Johnson began to advocate a system of agricultural research similar to those in operation in Germany. He described such a system near Saxony, where he had studied chemistry, as consisting of an experimental farm with laboratories and field research, for the exclusive purpose of promoting scientific research on behalf of farmers in the region.

The Civil War disrupted Johnson's plan to start a state agricultural research system in Connecticut, but in 1866 he helped establish a Board of Agriculture. In 1873, he was named chairman of a committee to study ways of setting up such an experiment station system. After 17 meetings, the Connecticut Board of Agriculture drew up a bill in 1875 to place such a station under its jurisdiction. The bill appeared doomed to defeat until a publisher and local agriculturalists took up the fight to have it passed. The legislature passed the bill and allocated funding for 2 years, thus, the first Agricultural Experiment Station was born October 1, 1875 at Wesleyan University. By 1877, the experiment station had proven its value and was set up on a permanent basis. It was controlled by a State Board which replaced the Wesleyan University trustees, who had governed the initial station.

Johnson's mistrust of the fertilizer industry was borne out by the first study at the newly formed Experiment Station, which was re-located at Yale University in New Haven in 1877. Johnson's experiment proved that the supposedly rich Peruvian guano being shipped to farmers in the northeastern U.S. was mostly harbor mud and decayed vegetable matter worth only $1.03 per ton, though it was selling for $32 a ton.

Another early advocate of the experiment station concept was Willard C. Flagg, who became a student of Scotland's Highland and Agricultural Society. While Johnson was working toward the experiment station concept in Connecticut, Flagg was espousing it in Illinois. Flagg soon realized that others who shared his goals also sought guidelines on uniform research procedures. In 1871 he persuaded Illinois University President John M. Gregory to call together the presidents and professors of 12 land grant institutions for a meeting in Chicago. A committee was set up to provide guidelines for experiments at agricultural colleges.

By 1874 interest in the experiment station concept had spread west to California. In that year Eugene Woldemar Hilgard was allotted $250 by the California legislature to organize studies on problems peculiar to California's topography and agriculture. By the 1880's experimental farms were in operation from Alabama (the Auburn Station began in 1883) to California.

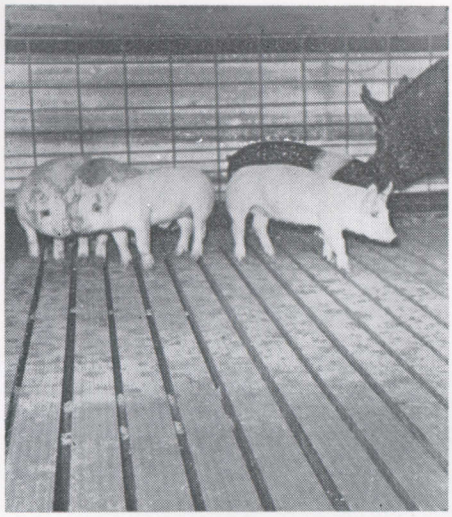
The experiment station idea caught on quickly, and in 1887 the U.S. Congress passed the Hatch Act, which provided for funding of experiment stations at land grant colleges in each state. The present agricultural experiment station system consists of experiment stations in all of the 50 states, Guam, The Virgin Islands, and Puerto Rico, with most states having substations for specialized research in different sections of the state.

In addition to developing thousands of new seed varieties, improved animal breeds, machines, and other scientific breakthroughs that allow 5% of the American population to produce food and fiber for the other 95%, there has been some research that isn't ordinarily thought of as agricultural. For example, in 1913, scientists at the Connecticut station discovered a substance in butter that is essential to animal growth. The substance was later named Vitamin A.

Not only do today's agricultural experiment station scientists have to be consumer watch dogs, like Samuel Johnson, they have to be ecology minded, economics minded, efficiency minded, and careful in general not to disturb their surroundings, while seeking ways of providing food, clothing, and shelter for the world. After 100 years of work, the task appears greater than ever for experiment station scientists, but the resourcefulness that prompted Samuel Johnson to question the validity of high priced fertilizer in 1857 will spur scientists from the Agricultural Experiment Station system to continue to develop new information which is the foundation of efficient agriculture.

Two Housing Systems Prove Equal For Confined Swine Nursery

D. J. JONES, *Department of Animal and Dairy Sciences*
J. L. KOON, *Department of Agricultural Engineering*
J. T. EASON, *Sand Mountain Substation*



Slatted floors reduced labor requirements for cleaning of swine nursery pens.

Low labor and land requirements have made confined swine rearing systems appealing to hog farmers. Unfortunately, there has been a scarcity of information about pig performance and labor for manure handling to identify the most desirable type of confinement nursery system for use in the South.

This lack of information prompted the construction of two swine nursery houses at the Sand Mountain Substation, Crossville, for use in research. The facilities provided for evaluating labor requirements and pig performance using two methods of manure disposal and five types of floors.

Each nursery measured 20 × 64 ft. and contained eight 8 × 16-ft. pens. One was built over a lagoon and the other over a pit.

Floors evaluated were: (1) 4 × 4-in. oak wood slats, (2) 4-in. aluminum slats, (3) 4-in. pour-in-place concrete slats, (4) 4-in. porcelainized steel slats, and (5) solid concrete floor. All slat spacings were 1 in.

Sows and their litters were placed in the nursery houses at 2 weeks post-farrowing and remained there until pigs were weaned at 8 weeks. Supplemental heat was provided as needed by the pigs, and an 18% crude protein creep ration was available at all times.

Method of waste disposal had no significant effect on pig average daily gain or on total creep feed consumed per pig during the 6-week test period. Pig daily gain averaged 0.65 lb. for those in houses above pits and 0.63 lb. for those above lagoons. Feed consumed per pig averaged 16.1 and 16.0 lb., respectively, for the pit and lagoon nurseries.

Gasses produced by manure decomposition can have a detrimental effect on pig performance. In this study, however, pigs performed equally well on each waste disposal system. Ventilation in both houses was maintained by ridge ventilators and by raising and lowering a drop curtain along the side.

Average ambient temperature was higher both day and night in the house over the lagoon, probably because water in the lagoon absorbed and later released heat. Although high temperatures could have a depressing effect on sow lactation, this was not reflected in pig performance in this study.

The floor system on which pigs were reared had no significant effect on average daily gain or creep consumption per pig. On the basis of pig performance in the nursery, therefore, the solid concrete floor had no advantage over a slatted floor.

Labor requirements differed widely between solid and slatted floors. Sows and litters confined to the fully concreted floor system required approximately 4 times as much labor as for those in pens with either porcelainized steel slats or aluminum slats, as shown by data in the table. Although there were fewer feet and leg injuries on fully concreted floors, high labor requirements would probably preclude their use.

Among the slatted floors, those made of oak wood had highest labor requirements. Some of these wood slats became warped, which increased time for cleaning. If wood slats are used, spacers should be placed every 2-3 ft. to assure uniform slot width. Also, only dried lumber should be used.

The most durable slats were those made of concrete and aluminum. These were easy to steam clean and few had to be replaced over the 5-year study period. An excellent concrete slat can be constructed on the farm (pour-in-place slats), provided proper care is given to proportioning the mix, casting the slat, and curing. Unless proper procedures are followed the slats may chip and crack, resulting in sharp cutting edges that can injure a pig's leg. Precast concrete slats that are on the market have the advantage of uniform quality of construction.

Many of the porcelainized steel slats had to be replaced because of rusting and deterioration, usually at a juncture with another slat or around the bolt securing slat to floor. The glass coating of the slat, which must remain intact to prevent rusting, appears subject to breakage at the points indicated.

Findings from the Sand Mountain Substation project indicate that either nursery housing system (pit or lagoon) with concrete or aluminum slats can adequately serve Southern hog producers. However, swine producers planning to build a nursery in the future may want to evaluate a waste disposal system which periodically flushes manure and urine from the nursery interior. This system shows promise of having low labor requirements while improving environment within the house. Such a system can be observed at the Main Station, Auburn.

Pig Performance and Labor Requirements on Five Floor Systems

Performance measure	Result, by type floor[1]				
	Concrete slats	Wood slats	Aluminum slats	Por. steel slats	Fully concreted
Average daily gain, lb.	0.62	0.65	0.63	0.66	0.64
Creep consumption/pig, lb.	15.6	16.4	15.7	16.1	18.0
Labor/sow and litter, min.	57	76	43	47	176
Labor requirement, pct. of fully concreted floor	32	43	24	27	100
Number of pigs	*421*	*360*	*473*	*371*	*140*
Number of litters	*51*	*44*	*59*	*55*	*18*

[1] Data cover 6 weeks—from 2 weeks post-farrowing to weaning time at 8 weeks. Labor given is for feeding and cleaning one 8 × 16-ft. pen containing one sow and litter.

[2] Total number of each type floor were: 4 concrete slats, 4 wood slats, 3 aluminum slats, 3 porcelainized steel slats, and 2 fully concreted.

Clean peanuts in foreground received 3 applications of dinoseb. Weedy plot in background got no herbicide (check plot).

MULTIPLE APPLICATION OF DINOSEB DELIVERS KNOCKOUT BLOW TO TOUGH PEANUT WEEDS

GALE A. BUCHANAN, *Department of Agronomy and Soils*

ELLIS W. HAUSER, *USDA-ARS*[1]

JAMES BANNON,[2] J. G. STARLING, and HENRY IVEY, *Wiregrass Substation*

If they had human emotions, Florida beggarweed and sicklepod would be worried about their future. Results of new research indicate that multiple applications of dinoseb[3] may be the weapon to provide victory over these two troublesome weeds in Alabama and Georgia peanut fields. Effective control of Florida beggarweed and sicklepod would represent a major accomplishment. Mechanical control is generally unsatisfactory, hand pulling is too expensive and herbicide treatments have not been satisfactory.

Dinoseb is the most widely used herbicide for weed control in peanuts, mainly as a cracking-time or early postemergence treatment, but single applications often don't get the job done. Often it is applied in combination with alachlor (Lasso), diphenamid (Enide, Dymid), or naptalam (Alanap), which provides some residual weed control.

Experiments were begun in 1970 using multiple applications of dinoseb. This was a team effort, with Auburn University Agricultural Experiment Station working with University of Georgia Experiment Stations and U.S. Department of Agriculture. Research was done in areas having a fairly heavy infestation of sicklepod or Florida beggarweed, or both. Results reported here are only from the Alabama test locations.

Peanuts in test plots were treated with benefin to control annual grass and small-seeded broadleaf weeds. Dinoseb was applied either alone or in combination with naptalam. Rates from 0.56 to 1.0 lb. per acre were applied with conventional ground sprayer set to deliver 15-20 gal. of spray per acre.

Control of sicklepod and Florida beggarweed was substantially better with 0.75 and 1.0 lb. per acre than with the 0.56-lb. rate. As many as six applications of the lowest rate did not give consistent control at the Wiregrass Substation. When the rate was increased to 0.75 lb., however, control was acceptable from only four applications. Where sicklepod was the predominant weed species, six applications were required for satisfactory control. Two applications at 1.0 lb. per acre gave control in one experiment.

Dinoseb did a better job of killing the weeds immediately after they emerged than after true leaves began expanding. Activity was considerably better with 0.75 and 1.0 lb. per acre than with 0.56 lb. Further observations revealed that Florida beggarweed was more susceptible to dinoseb than was sicklepod.

Yield of peanuts was not reduced by six or fewer applications of 0.56 and 0.75 lb. per acre. Eight applications tended to lower production.

Yields indicate a surprising tolerance of peanuts to repeated applications of dinoseb. Based on 4-year findings, peanuts will tolerate at least four applications of dinoseb at 0.75 lb. per acre. It is important to remember, however, that factors such as temperature, spray coverage, and previous pesticide treatments may affect susceptibility of peanuts to dinoseb as they influence weed control success.

Effectiveness against the two troublesome weeds – Florida beggarweed and sicklepod – and safety on peanuts in the research reported suggest that multiple applications of dinoseb will fill a need in future weed control programs. The treatments described are not presently labeled, but such label clearance is expected for the 1976 growing season.

Effect of Multiple Applications of Dinoseb on Control of Sicklepod and Florida Beggarweed, Percent Peanut Injury, and Peanut Yield, 1971-73

Dinoseb rate and number of applications	Weed control			Peanut injury			Peanut yield/acre		
	1971	1972	1973	1971	1972	1973	1971	1972	1973
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Lb.*	*Lb.*	*Lb.*
0.56 lb./acre									
1	31 b	25 c	20 e	0 b	0 a	2 fg	1,976 ab	3,889 a	2,865 ab
2	44 ab	48 bc	44 de	0 b	0 a	0 g	1,976 ab	2,920 a	2,960 a
4	28 b	74 ab	43 de	0 b	0 a	2 fg	2,124 ab	3,181 a	2,865 ab
6	76 a	60 abc	20 e	0 b	0 a	2 fg	2,058 ab	4,134 a	2,594 ab
8	70 a	99 a	29 de	13 a	0 a	22 b	1,471 bc	2,502 a	2,358 b
0.75 lb./acre									
1	41 b	13 c	25 de	0 b	0 a	0 g	1,829 abc	3,916 a	2,801 ab
2	36 b	64 abc	54 de	0 b	0 a	0 g	2,271 ab	2,756 a	2,901 ab
4	53 ab	81 ab	85 ab	0 b	0 a	5 defg	2,375 a	3,473 a	2,697 ab
6	82 a	86 ab	83 abc	0 b	0 a	4 efg	1,975 abc	2,774 a	2,883 ab
8	91 a	100 a	88 ab	14 a	0 a	19 bc	1,323 c	2,212 b	2,344 b
1.0 lb./acre									
1	-----	-----	51 de	-----	-----	0 g	-----	-----	2,883 ab
2	-----	-----	98 a	-----	-----	0 g	-----	-----	2,937 ab
4	-----	-----	96 a	-----	-----	3 efg	-----	-----	3,060 a
6	-----	-----	86 ab	-----	-----	12 bcd	-----	-----	2,556 ab
8	-----	-----	98 a	-----	-----	33 a	-----	-----	2,430 ab
Control	0 c	0 d	0 f	0 b	0 a	0 g	1,666 abc	2,614 a	2,843 ab

[1] Values within a column not followed by the same letter are significantly different at the 0.05 level.

[1] Georgia Coastal Plain Experiment Station, Tifton, Georgia.

[2] Formerly Assistant Superintendent, Wiregrass Substation, and now Graduate Assistant, Louisiana State University.

[3] Dinoseb is the common name for 2-*sec*-butyl-4-6-dinitrophenol. Amine salts are soluble in water and have some selectivity. Often referred to simply as "Dinitro," dinoseb is sold under trade names such as Premerge, Basanite, Sinox PE; combinations with naptalam are sold as Ancrack, Dynap, Klean Krop, and Marauder.

A CHANGING DAIRY INDUSTRY

L. E. WILSON, *Department of Agricultural Economics and Rural Sociology*

THE DAIRY INDUSTRY in Alabama and the United States has undergone dramatic changes since the early 1960's that affected milk producers, processor-distributors, and retailers. Rising production and marketing costs resulted in sharp retail price increases in the past few years, which caught the attention of consumers.

Alabama is primarily a fluid milk market with practically all commercial sales of milk from Grade A dairies. The number of dairies reached a peak of over 2,200 in the early 1950's. With adoption of bulk milk tanks in the late 1950's and other cost increasing changes on the farm, many small producers left dairying. By 1959 the number had declined to 1,673 Alabama dairymen plus 301 out-of-state dairymen supplying milk to Alabama processors, see table. In the past 15 years, the decline continued. Remaining dairymen expanded herd sizes and increased production per cow so that total milk sales increased. Demand for fluid milk products increased more rapidly, however, and more out-of-state milk producers were solicited to ship to Alabama markets. Dependence on out-of-state milk has increased from less than 20% of total supply in the early 1960's to about 28% in 1975, when in-state production declined over 8%. The decline in commercial sales in 1975 was the first experienced in Alabama's dairy industry.

In the late 1960's two producer cooperatives became active in milk marketing in the State. These cooperatives are Associated Milk Producers of Alabama (AMP), with the main office in Montgomery, and Dairymen, Inc. (DI), a regional dairy marketing association, with headquarters in Louisville, Kentucky. AMP is a state-wide association with out-of-state membership primarily in Tennessee and Mississippi. DI, which was formed by merger of smaller cooperatives, has membership in about 8 Southern States. Currently, over two-thirds of milk marketed in Alabama is through these associations. The remaining volume is marketed by independent milk producers who ship directly to specific processors.

NUMBER OF PRODUCERS AND AVERAGE DAILY SALES OF PRODUCERS SUPPLYING MILK TO ALABAMA MARKETS, SELECTED TIME PERIODS, 1959-1975

Year	Alabama producers	Out-of-state producers	Av. daily sales
	No.	*No.*	*Lb.*
1959	1,673	301	728
1964	1,231	163	1,311
1973	650	208	2,624
1975	567	266	2,893

Source: 1959 and 1964 data from Alabama Experiment Station Bulletin 371; 1973 (July) and 1975 (January) data from the Alabama Dairy Commission.

Producer marketing associations engage in such activities as milk hauling, pooling supplies, diverting milk to its best use, seeking new markets, bargaining for prices, and representing producers before regulatory agencies and legislative bodies. Following cooperative organization in Alabama, an early effort was to gain control over farm-to-market assembly of milk. Lower rates were negotiated; later the Alabama cooperative gained control over hauling. Following a study of hauling costs in 1973, a rate schedule was developed based on volume of milk shipped and distance of the producer from the market. The schedule was adopted by the cooperative and in 1975 about three-fourths of farm-to-market assembly is under the common schedule. The rates have also been adopted by haulers of independent producers' milk.

Producer cooperatives on a significant scale were late in developing in Alabama. Favorable Class I prices and the ability of individual producers to maintain a high blend price through a quota system discouraged cooperative development for years. In the 1960's, Alabama producers recognized the need to organize and act on their own behalf. The old Milk Control Board did not (and could not) provide all the market services needed by dairymen. Further, the future of the Board was uncertain. Subsequently, the State Legislature changed certain provisions of the milk control act. The notable revision was a change in membership of the agency from an industry dominated board to a five-member consumer commission.

Number of milk processors declined from around 50 in the early 1960's to 23 Alabama processors in 1975. Most processors leaving the business were small producer-distributors and local independent firms. However, two Alabama plants operated by regional and national chains were closed. Their customers are being served by the same brands being processed under their brand label by other dairies and from other plants operated by the chains. In early 1975 the seven largest plants processed an average of 32,000 gal. per day (12,000 gal. per day in 1960). Currently the four largest milk processing firms in the State operate 11 plants which process over 60% of the fluid products in the State.

Entrance of integrated processing operations by grocery chains and a producer cooperative occurred about 1970. One grocery chain constructed a limited line milk processing plant in Alabama while another purchased an existing plant. Some grocery chains are being served by their brands which are processed in other states. In other instances, conventional processors are packaging milk for grocery chains under the chain's label. Fluid milk products from six integrated operations are being distributed in Alabama. Three of these plants are located in the State.

Changing shopping habits of consumers brought about a shift in milk distribution from home delivery to store sales. In January 1975, slightly over 90% of milk sales in Alabama was through wholesale distribution. As milk is a major grocery item, large grocery store accounts are eagerly sought by processors. Economies are gained in selling and distribution from serving large volume accounts. Thus, much bargaining strength in the industry shifted to grocery chain management.

The Alabama Dairy Commission regulates the fluid milk market at all levels. The Commission and its predecessor the Milk Control Board have regulated the state's dairy industry since the mid-1930's. Alabama has one of the oldest continuous state milk regulatory programs in the country.

State regulatory programs where retail prices are established have long been subject to controversy. State control of milk prices has been eliminated in several states including Georgia, Mississippi, and Florida. However, the evidence is not conclusive that consumers in these states have benefited. Attempts are being made in some of these states to reestablish regulatory agencies.

Future adjustments will likely be a continuation toward fewer but larger production units and a further expansion of producer controlled marketing activities. Processors will continue to exit. Remaining plants will increase in scale of operation while seeking more economical distribution systems. Grocery chains will likely integrate further into processing unless the industry services their demands.

Some Ways To Conserve Tractor Fuel

ELMO RENOLL, *Department of Agricultural Engineering*

Agriculture in the U.S. is presently using about 4 billion gal. of gasoline and 2.5 billion gal. of diesel fuel per year. This is more petroleum than is used by any other industry. While petroleum usage has gradually increased, the proportion used in agriculture has changed very little during the past 35 years.

The past 2 years has been the first time in over a quarter of a century that agriculture has given serious consideration to its fuel supply. In that 24-month span the price has risen sharply and the supply has often been interrupted. Thus it is imperative for the farm manager to be certain that each tank full of fuel is used as efficiently as possible. He needs to consider carefully which of his tractors to use and how each will be operated.

The following tips for efficient tractor and machinery operation are suggested: When there is a choice of gasoline, diesel or LP gas, use diesel. For tractors of about equal size doing the same amount of work, the diesel engine uses less fuel. For example, if a diesel tractor used 75 gal. of fuel to complete a specific field operation, a gasoline tractor would have used 100 gal. and an LP gas tractor 120 gal.

Keep the tractor engine tuned. A gasoline engine which is properly adjusted for carburetion and ignition will use 12 to 15% less fuel than the improperly tuned engine. Keeping the diesel engine in top condition pays off with a 10 to 12% fuel savings. Check air cleaner frequently, especially under dusty conditions. A clogged filter increases fuel consumption and tends to reduce tractor power.

Do a better job of matching the load to the tractor. Use a small tractor for lighter loads. For larger tractors, consider coupling equipment together to do several jobs at one time. This will save extra trips over the field and will operate the tractor nearer full load where fuel efficiency is high.

Avoid lugging or overloading the engine. If engine speed lugs down, shift into a lower gear. This saves fuel and reduces engine wear.

If the tractor is not pulling a full load, throttle the engine down and shift into a higher gear.

Consider using minimum tillage or other cultural practices which can either reduce the required horsepower or the total hours of operation. Using minimum tillage on corn, for example, can reduce fuel needs 30% or more. Similar savings for minimum tillage soybeans can be expected.

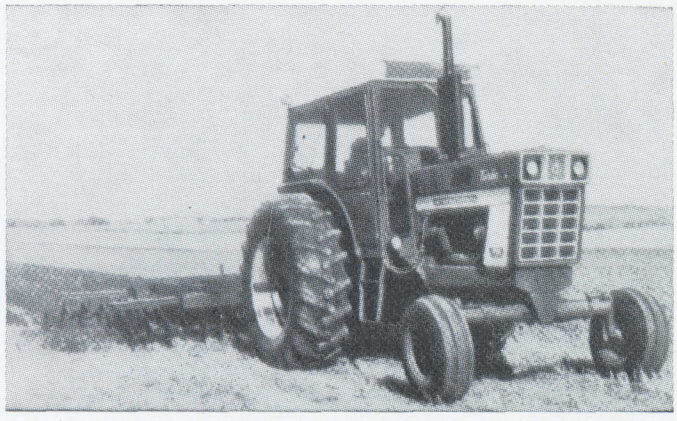
If tractors or self-propelled machines are moved long distances, consider using a truck rather than driving them on the road. This will save fuel and it is safer.

Efficient field operations require good traction. Excessive wheel slippage causes undue tire wear and wastes fuel. Consider changing wheel weights according to field conditions to maintain good traction without excessive weight.

Keep idle field travel time for tractors and self-propelled machines to a minimum. Shut the engine off while making field adjustments, loading supplies or servicing equipment.

Operate machines at proper ground speeds. Have them properly serviced and correctly adjusted. See that cutting edges are sharp. Mowing machines and forage choppers with dull knives require extra horsepower. Dull shares on a moldboard plow increase power needs by 10-15%.

If these suggestions are correctly applied they should reduce operating costs, save time and labor, increase operation efficiency and conserve fuel.



Large tractors are needed for heavy field work. These tractors can also be used to pull several machines at the same time thus saving fuel and reducing trips across the field.

Matching the tractor size to the job is an efficient way to operate and conserve petroleum fuels. For light loads, small tractors are more efficient than large ones.

Partial Shading Gives Better Arizona Cypress Seedlings

WALTER D. KELLEY, *Department of Botany and Microbiology*

PRODUCTION OF GOOD quality Arizona cypress (*Cupressus arizonica* Greene) seedlings is no easy task. Alabama nurseries growing these seedlings have been beset by problems for several years. Research by Auburn University Agricultural Experiment Station has found no sure cure for disease problems, but results point to an insect, the lesser corn-stalk borer, as a production problem.

Auburn research, done in cooperation with the Alabama Forestry Commission, has been directed toward control of foliar diseases. Most prominent foliar disease at the Auburn Forest Nursery is a tip blight caused by the fungus *Curvularia intermedius,* which was first observed in 1966. Since then the number of seedlings in nursery beds exhibiting symptoms of this disease has approached 80% during some growing seasons.

Earlier control research indicated that (1) the disease may occur sporadically one year and be sparse or absent the following year; (2) most damage to seedlings occurred during the hottest part of the summer – July and August; and (3) many necrotic lesions not attributable to *C. intermedius* or any other microorganisms were present on the seedlings each year (apparently of physiological origin).

Field plots were established at the Auburn Forest Nursery to evaluate potential control measures against the disease problem. Treatments tried during the 2 years included different fungicides, with and without shading.

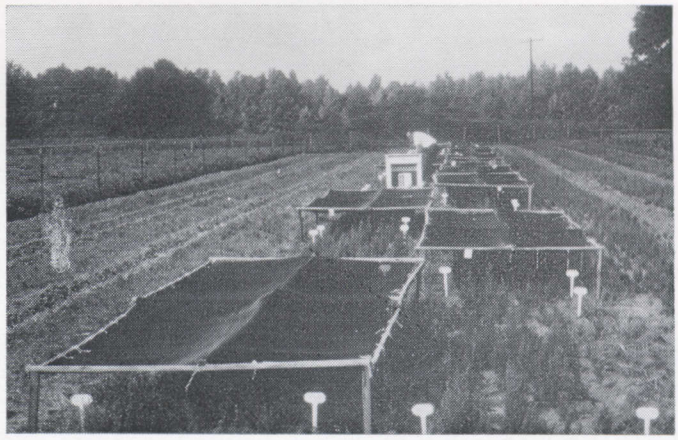
In the first study year, three fungicides were evaluated for effectiveness against *Curvularia* tip blight: DuTer 47.5 WP (triphenyl tin hydroxide), Difolatan 4-F (captafol), and Benlate 50 WP (benomyl). A single rate of each fungicide was tried in six plots, with three of the six plots shaded with Saran shade fabric (63% shade). Shading was included to determine if lower soil and foliage temperatures would reduce physiological damage. Shade fabric was erected on wooden rails 24 in. above ground.

EFFECT OF FUNGICIDES AND SHADING ON DISEASE INCIDENCE AND SEEDLING HEIGHT OF ARIZONA CYPRESS

Treatment, fungicide and rate per 100 gal. water	Disease index[1]		Seedling height	
	First year	Second year	First year	Second year
			Cm	*Cm*
Control	2.27 b[2]	2.66 c	15.5	12.2
Control (shaded)	2.17 bc	2.26 c	17.8	16.5
DuTer 47.5 WP, 0.3 lb.				
Not shaded	2.57 a	.....	15.3	.....
Shaded	2.23 b	.....	17.2	.....
Difolatan, 40 fl. oz.				
Not shaded	1.50 e	2.77 ab	15.2	11.1
Shaded	1.83 cd	2.27 c	15.8	18.8
Benlate 50 WP, 0.4 lb.				
Not shaded	1.93 c	3.00 a	17.4	14.2
Shaded	1.67 de	1.87 d	20.1	18.8

[1] Disease index on scale of 1 to 5: 1 = 0-20% of growing tips diseased; 2 = 21-40%; 3 = 41-60%; 4 = 61-80%; and 5 = 81-100% (dead).

[2] Numbers followed by the same letter within a column are not significantly different from one another ($p>0.05$).



Shade cover suspended above Arizona cypress seedlings resulted in less disease incidence than on seedlings grown in the open.

Plots were randomly selected for treatment and for shading. Fungicides were applied on a 2-week spray schedule beginning the first week of June and terminating in late August. Data were collected within a week after spraying was stopped. All seedlings in two subplots in each plot were individually evaluated for disease and their heights measured. Each seedling was assigned a disease index based on the percentage of diseased growing tips, as recorded in the table. The study was the same the second year, except that the fungicide DuTer was omitted.

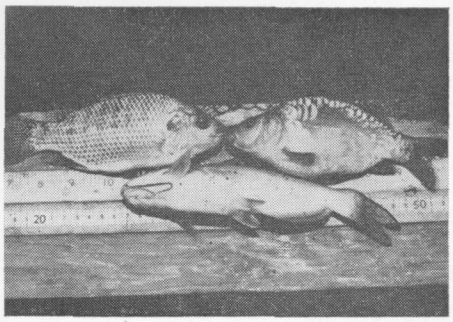
Severity of the disease problem is indicated by disease indices reported in the table. Disease incidence was high during the first year and even higher the second. Of the fungicides tested the first year, Difolatan and Benlate significantly reduced disease incidence. DuTer caused some seedling injury. During the second year, Difolatan was not effective, but Benlate under shade reduced disease incidence.

Any fungicide treatment under shade gave better disease control than the corresponding unshaded plot, as shown by disease index ratings. Midday soil temperatures in shaded plots were 9°C (16°F) lower than on non-shaded plots. Lower soil temperatures could have resulted in a reduction of the physiological damage observed in earlier research.

Close examination of some necrotic lesions during the second year revealed what appeared to be insect damage. Subsequent investigations showed the damage was caused by the lesser corn-stalk borer (*Elasmopalpus lignosellus* Zeller). This uncontrolled variable complicated interpretation of disease data.

As expected, seedlings grown under shade were taller than those in open plots. However, height was not increased enough to reduce seedling quality.

These results indicate (1) none of the fungicides, at the rate and treatment interval tested, reduced disease incidence to an acceptable level; (2) seedlings grown under shade generally exhibited less disease than their counterparts in the open; and (3) control of the lesser corn-stalk borer will be necessary for future fungicide evaluation studies.



Many other types of fish of excellent eating quality have much lower feed and water quality requirements than catfish, such as talapia or carp shown above the catfish.

CATFISH are not the only FISH in the POND

E. W. McCOY, and K. W. CRAWFORD
Department of Agricultural Economics and Rural Sociology

UNDER WILD or uncultured conditions catfish coexist with numerous other species of fish, each utilizing a different segment of the food chain. Natural production, of course, does not yield the harvestable poundage obtained under intensive culture with supplemental feeding.

During 1974 about 1,900 Alabama farmers devoted approximately 11,000 acres of water to catfish production. Less than 1,000 of the producers grew fish for sale through the various available markets. The remaining catfish producers maintained recreational ponds for their own use and to provide fishing for friends and relatives. Catfish production, even for personal use ponds, was similar to feedlot operations for cattle or swine. The fish were stocked in ponds usually at sizes ranging from 3 to 10 in., 0.01-0.33 lb. each, and were fed a high protein, complete nutrient ration. Little growth was obtained by fish feeding on natural foods available within ponds.

Two biological factors limit production when catfish are stocked and fed at relatively high rates under conditions similar to those discussed. First, catfish do not utilize feed efficiently when water temperature is below 60°F. Second, total nutrients available in the pond are underutilized. Catfish do not consume and convert all of the ration fed into flesh. Both the unutilized feed and catfish biological waste products enrich the nutrient level of the pond.

Another limiting factor in catfish production for many farmers is the inability to maintain water quality in their pond situation. Aquatic organisms that are noncompetitive with catfish for nutrients, have economic value, and improve water quality would be ideal for inclusion in catfish culture. Such organisms could include both plants and animals.

Researchers are interested in aquatic organisms that can extend the use of production facilities and/or utilize the excess available nutrients during the catfish growing season. Ideally, such aquatic organisms should have economic value, but this is not a necessary condition. In cases where increased value or decreased cost of producing catfish exceeds cost of incorporating these types of organisms, then they could feasibly be included in the production unit.

Trout perform well when water temperature is below 60°F. Good water quality is required by trout, but the condition is somewhat easier to maintain under relatively cool water temperatures. Several Alabama producers with sufficient water supplies are double cropping their ponds or raceways. Trout are stocked in late fall, fed through the winter months, and harvested during the early spring when the water temperature is warming. Ponds or raceways are immediately restocked with catfish which reach harvestable size by fall. The feed requirements for trout and catfish are similar although catfish can be fed a lower cost ration. The feed conversion ratios for trout and catfish are approximately the same. The demand for trout is high for both recreational and market sales, and the resulting high liveweight price provides a good profit margin. So, in some instances the trout operation with its higher variable costs is more profitable than catfish.

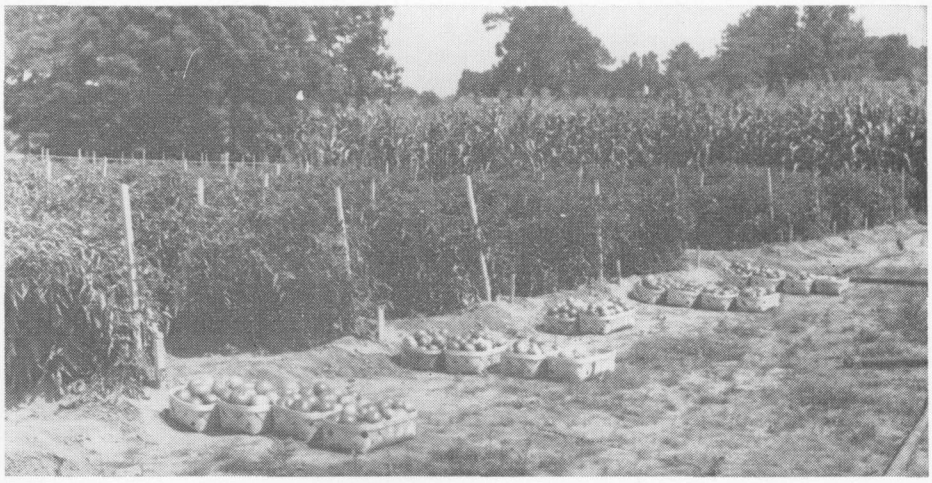
A species that has been successfully cultured for quite a while is the bait minnow. Many fishermen who regularly purchase bait minnows do not realize that the fish are pond raised. Bait minnow production is highly developed in the Mississippi Delta and dealers haul the small fish to all parts of the country. Alabama has one major bait minnow producer who operates on a similar basis. Some biological research has shown that the bait minnow can be successfully utilized to capture excess food supply in the pond when catfish fingerlings are small. Then as catfish become larger, they consume the bait minnows, thus utilizing those excess nutrients captured early in the production period.

Buffalofish, carp, Tilapia, and other species biologically appear to complement catfish well under polyculture conditions. Since a pond is a three-dimensional space containing both plants and animals, fish that graze on aquatic plants and fish that feed on aquatic animals should utilize a high degree of the available nutrients in a pond. Unfortunately, the market demand for many of these species as food fish is relatively low. Under these circumstances incorporation of a second fish species in the pond must increase the production of catfish or the net market gain from the second species must exceed the reduced market of catfish. For example, if catfish sell for 45¢ per lb. and Tilapia at 15¢ per lb., 3 lb. of marketable Tilapia must be sold for every pound that catfish production is decreased. In a wild or natural state these two species are not competitors. Under pond conditions with supplementary feeding, however, many of the Tilapia consume the feed ration rather than seeking natural food items, much like steers on pasture that will consume grain if available in preference to grass.

Many other types of fish of excellent eating quality have much lower feed and water quality requirements than catfish and require much lower levels of capital and management. Common carp, considered a trash fish in the United States, have low level capital and management requirements. Although not produced extensively in this country, they are the most widely cultured fish in the world.

In conclusion, catfish are not the only fish in the pond and research can lead to new combinations for polyculture systems which will utilize each niche in the food chain and return output to input ratios unthinkable at the present time.

Marketable tomato yields went as high as 750 bu. per acre from one harvest when grown with adequate water and fertilizer.



Medium N Rate, Irrigation Level Best for Staked Tomatoes

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C. E. EVANS, *Department of Agronomy and Soils*
W. A. JOHNSON, *Department of Horticulture (Retired)*

BOTH YIELD AND SIZE of tomatoes are increased by irrigation and nitrogen applications. But there's no need to use large amounts of either. A medium irrigation level and low to medium N rates combined to give most profitable production in Auburn University Agricultural Experiment Station research.

Experiments were conducted at Thorsby during 1971-73 with the objective of identifying nitrogen needs and learning the value of supplemental irrigation. Five rates of fertilizer N at three levels of irrigation (furrow method) were evaluated.

Irrigation levels were: (1) no irrigation, (2) irrigated when 30% of available water remained in the soil – *intermediate level,* and (3) irrigated when 60% of available water remained – *high level.* The intermediate level allowed the soil to become relatively dry, but not dry enough to cause plants to wilt. High irrigation kept the soil at a high level of moisture at all times. Rainfall during the growing season was about 95% of normal during 1971 and 1973, but only 60% in 1972.

Nitrogen application rates were 0, 60, 120, 180, and 240 lb. per acre. All plots were fertilized with P and K according to soil test.

Best known cultural practices were used for the staked tomatoes, and spraying was done regularly to control insects and diseases. Tomatoes were harvested at weekly intervals from late June until late August.

MARKETABLE TOMATO YIELDS AT FOUR N RATES AND THREE IRRIGATION LEVELS, 1971-73

Lb. N/acre	Per acre yield by irrigation level		
	None	Intermediate	High
	Lb.	*Lb.*	*Lb.*
1971			
0	39,100	45,500	40,000
60	53,100	47,200	53,300
120	48,300	49,000	55,400
180	49,700	50,300	49,900
240	43,400	50,100	51,800
1972			
0	52,700	63,800	63,300
60	64,200	86,800	80,300
120	56,600	82,400	95,100
180	64,000	88,400	83,900
240	47,900	73,200	93,600
1973			
0	42,200	42,500	39,700
60	52,200	60,600	41,900
120	53,800	69,000	54,900
180	59,400	67,500	54,300
240	53,500	60,500	68,000
1971-73 average			
0	44,700	50,600	47,700
60	56,500	64,900	58,500
120	52,900	66,800	68,500
180	57,700	68,700	62,700
240	48,300	61,300	71,100

Growth, Yield Differences

Rate of plant growth early in the season and plant height at beginning of harvest were influenced more by N rate than by irrigation. Most increased plant height resulted from the first 60 lb. per acre of N. Higher rates gave little additional growth stimulation. Plants averaged 30 to 40 in. tall at beginning of harvest over the 3-year period.

Marketable yields were highest in 1972 and lowest in 1971, as shown by data in the table. Supplemental irrigation did not increase yields in 1971 or 1973, but nearly doubled production in 1972. Highest yield in the 3 years was in 1972 on irrigated plots. Although rainfall was low during July 1972, adequate moisture from irrigation resulted in high yields.

Applied N increased marketable tomato yields each year. There was a yield increase from 60 lb. per acre in 1971 and 1972, but no additional boost from higher rates. In 1973, yields were increased by 120 lb. Total 3-year average marketable yields ranged from about 45,000 lb. per acre (with no N and no irrigation) to approximately 71,000 lb. at the 240-lb. N rate and high irrigation.

Fruit Size Affected

Both rate of N and irrigation affected fruit size of tomatoes. In general, the percentage of large tomatoes increased as irrigation increased but decreased with progressively higher rates of N. An average of all treatments for all years shows 70% of marketable tomatoes were large (diameter 2 11/16 in. or greater), 16% were medium (2½ to 2⅞ in.), and 14% were small (diameter 2¼ to 2⅝ in.).

Cull tomatoes made up about 14% of total yield regardless of irrigation. Most cull tomatoes were from catfacing, which is probably not greatly affected by soil fertility or moisture.

The yield increase from irrigation was limited to the intermediate irrigation level, indicating no advantage to keeping soil moisture at a high level all the time. Applied N increased marketable yields all years, but yield response was limited to 60 lb. per acre for 2 years and to 120 lb. the other year.

Based on results reported, the best combination of supplemental irrigation and applied N rate was 60 to 120 lb. per acre of applied N and irrigation as needed to maintain 30% or more available water in the surface 2 ft. of soil.

BERMUDAGRASS TREMORS IN CATTLE IN ALABAMA

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Bermudagrass tremors (BGT) affected about 25,000 cattle in over 500 herds in central and northeastern Louisiana in 1971, resulting in the death of at least 600 animals. Similar, but less spectacular, outbreaks have been reported in Mississippi. BGT affects the nervous system, causing cattle to become extremely excitable. Infected cattle twitch, tremble, lose body coordination, become stiff-legged in the hind quarters and weak in the front legs, and may eventually fall down, getting up again only with great difficulty. Cattle stay alert, but quickly lose condition as weight gain or milk production decreases. Milk production in one cow dropped from 35 to 6 lb. per day and body weight dropped by 100 lb. in 3 weeks. Spontaneous abortions are commonly associated with the disease.

Deaths associated with BGT usually are caused by secondary effects, such as pneumonia, animals falling in stock ponds or bog holes and drowning, or from dehydration as weakened, uncoordinated cattle are unable to get to water. Animals recover readily when removed from toxic pastures or hay and placed in feedlots on grain or non-bermudagrass forages. Research at Louisiana State University, and later at Auburn, indicated that only cattle are affected, since toxic hay had no effect on rats, guinea pigs, rabbits, or chickens. BGT was not contagious, nor was it caused by pesticides, high nitrates, mineral imbalances, selenium and molybdenum toxicities, or grass tetany. Toxic hay clipped in October remained toxic 4 months later, even after being held at 120° C for an hour. Animals showed symptoms in 36 hours, and symptoms remained for a long period of time before death occurred; recovery occurred in 2 to 12 days after removal of toxic hay. The toxic factor was not present in milk.

A similar nervous disturbance was observed in 1950 in east-central Oklahoma. Symptoms were similar to those described in Louisiana 20 years later. No ergot was detected on the bermudagrass. In 1953, a paralysis of cattle resembling BGT, but designated "downer cows" or "bermudagrass poisoning," occurred in Georgia and Alabama.

In the fall of 1973, commercial Coastal bermudagrass hay from Autauga County was associated with toxicity and death of several cattle that had shown tremors or staggers symptoms. Several bales of toxic hay were brought to Auburn for analysis. Twenty species of fungi were isolated from the hay, identified, and bioassayed for toxicity to brine shrimp and chicken embryos, see table. Ten of the more toxigenic fungi (rating 4-6) were each grown on one-half bale of sterilized bermudagrass hay for several weeks. The hay was dried and fed to calves, but none of the fungi was toxigenic under those conditions.

In September of 1974, 40 of 50 cattle in a pasture at the Plant Breeding Unit near Tallassee, Alabama were afflicted with a disease that resembled what has been described as BGT or staggers. Once pesticides were ruled out as the cause, the possibility of induction by fungal toxins was investigated. Fifty bales of hay were made from infested areas. About one-fourth bale induced tremors in 36 hours in a 350 lb. calf at Auburn. Pelleted toxic hay and extracts were prepared and fed to hamsters, gerbils, and mice as well as guinea pigs, rats, rabbits, and chicks with no toxic or tremorgenic effects. A rapid, inexpensive bioassay system for the toxic principle is urgently needed.

The predominant fungus present was isolated and identified and it was not one of the fungi previously isolated from bermudagrass hay in the 1973 studies. Research is currently underway to determine whether this fungus was the toxin producer or if another fungus of low frequency is involved. The authors ultimately expect to isolate and identify the fungal toxin(s) involved and to develop control measures for prevention of fungal growth and toxin formation on bermudagrass. There are also possibilities of developing an antidote or treatment for afflicted cattle in cooperation with the School of Veterinary Medicine at Auburn.

Toxicity of Fungi Isolated from Bermudagrass Hay (1973) to Brine Shrimp and Chicken Embryos

Fungus Genus Species	Brine[1] shrimp	Egg[2] Sac	Egg[2] Yolk	Priority rating[3]
Drechslera halodes	0	2	2	4
Cladosporium herbarum	0	1	1	2
Penicillium lanosum	2	2	1	5
Cochliobolus spicifer	0	2	2	4
Paecilomyces varioti	2	2	2	6
Cladosporium sp.	0	2	2	4
Fusarium lateritium	0	0	0	0
Gliocladium fimbriatum	2	2	2	6
Epicoccum purpurascens	0	1	2	3
Aspergillus fumigatus	2	2	2	6
Acremonium sp.	0	2	2	4
Mucor sp.	0	0	0	0
Curvularia lunata	0	0	0	0
Nigrospora sphaerica	1	2	2	5
Periconia minutissima	0	0	0	0
Pithomyces chartarum	0	0	0	0
Virgaria nigra	0	0	0	0

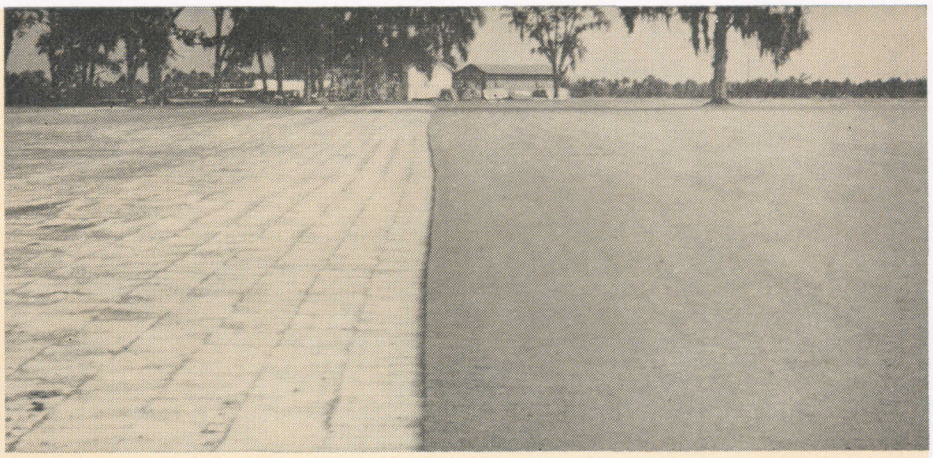
[1] 2 = 60-100% mortality of shrimp; 1 = 20-59% mortality; 0 = 1-19% mortality; about 50 brine shrimp per ml.

[2] 2 = 80-100% mortality of chicken embryos; 1 = 41-79% mortality; 0 = 0-40% mortality; 5-10 eggs and injection method.

[3] Fungi with a priority rating of 4-6 are bioassayed for toxicity to rats.

HOW MUCH N FOR GOOD SOD?

C. H. MITCHELL and RAY DICKENS
Department of Agronomy and Soils



Nitrogen rate of 0.5 lb. per 1,000 sq. ft. applied at either 2- or 4-week intervals resulted in superior sod strength.

TIFWAY AND TIFGREEN bermudagrasses are grown extensively for athletic turf, lawns, and roadside erosion control in the Southeast. Tifgreen is used on golf course tees and greens because of its finer texture and tolerance to low mowing, while Tifway is preferred for fairway use. Sod producers like both because of their rapid growth rates.

Past recommendations for sod production have called for high rates of nitrogen (9 lb. per 1,000 sq. ft. per year). Increasing costs of nitrogen fertilizer, however, demanded a new look at the economy of such rates. Results of new research at Auburn University Agricultural Experiment Station indicate that lower rates of N can be used without sacrificing growth rate of the two bermudas.

EFFECTS OF NITROGEN RATES AND APPLICATION FREQUENCY ON TENSILE STRENGTH OF TIFGREEN AND TIFWAY SODS

N/1,000 sq. ft. and app. frequency	Tensile strength of sod			
	Tifgreen		Tifway	
	1973	1974	1973	1974
Every 2 weeks				
½ lb.	29 abc*	26 ab	49 bc	39 ab
1 lb.	26 cd	26 ab	44 cd	35 abc
2 lb.	23 de	25 ab	40 d	31 bc
Every 4 weeks				
½ lb.	32 a	29 a	61 a	36 abc
1 lb.	30 ab	27 a	54 ab	40 a
2 lb.	27 bc	25 ab	42 cd	35 abc
Every 8 weeks				
2 lb.	27 bc	23 ab	45 cd	30 c
No N	21 e	21 b	30 e	28 c

* Means within a column not marked by same letter are different ($P \leq 0.05$).

New Growth Factors Considered

Nitrogen recommendations formerly were based on such factors as clipping yield, shoot density, and general appearance. Extent of root, rhizome, and stolon development was not considered, despite the fact that tolerance to traffic and recuperative potential are improved by an abundance of roots, rhizomes, and stolons. Thus, these growth criteria represent a crucial factor in growing turfgrass for the cut sod industry and for maintaining sod on athletic fields and golf courses.

Length of time to produce a dense, high quality sod – one suited for harvesting or that will tolerate traffic – is another important production factor. Mowing heights are known to affect the rate of sod formation by cool season grasses, but no such information is available on bermudagrass.

N Rates, Mowing Heights Studied

Experiments over a 2-year period on a Dothan sandy loam soil at Auburn measured the effects of nitrogen and mowing heights on sod formation by bermudagrass. The test area was fertilized (except for nitrogen) and limed according to soil test recommendations. The area was roto-tilled, smoothed, and planted in mid-June with 2-in. plugs on 10-in. centers.

Nitrogen and mowing treatments were begun 1 week after planting. Three N rates and three application frequencies were included, along with mowing heights of ½, ¾, and 1 in. Frequency of mowing was twice weekly. Weeds were controlled with MSMA and 2,4-D or 2,4-DP. Clippings were removed at each mowing.

Sod formation was evaluated by measuring tensile strength of the sod. Sod strips (2 × 1 ft.) were harvested at ½-in. depth and fastened to a platform, half of which was stationary and half mounted on wheels to move along a track. Tension was applied to the moveable section until the sod strip tore apart. Amount of tension required to tear the sod apart was the measure of sod strength.

Tifway Stronger

Tifway produced sod strengths 30-50% greater than Tifgreen during both years. There were no measurable differences in sod strength as a result of mowing heights. Evidently both grasses are capable of forming dense sods when mowed as low as ½ in.

Strongest sods were produced with low rates of N, 0.5 to 1.0 lb. per 1,000 sq. ft. Fertilization at 4-week intervals gave results equal or superior to those obtained with 2-week frequency. Although higher rates of nitrogen may produce a more pleasing appearance and uniform establishment rate, these results show little effect by high rates on strength of mature sod. Likewise, continuous low mowing during the early part of the sod growing operation may not be necessary to produce strong sods. Factors other than sod strength must be considered when developing a sod production program, however. Of importance are effects of mowing heights and nitrogen fertility on weeds, appearance, diseases, and insects, as well as on mechanical harvesting and regrowth after harvest.

Superior sod strengths were obtained from nitrogen rates of 0.5 lb. per 1,000 sq. ft. regardless of whether the application interval was 2 or 4 weeks. Mowing heights from ½ to 1 in. had little effect on sod strength.

The Southern Pine Beetle

L. L. HYCHE, *Department of Zoology-Entomology*

EPIDEMIC CONDITIONS *in 53 of 67 counties. Eleven million acres of forest land affected." "31 million board ft. of infested sawtimber and 12 million cubic ft. of pulpwood harvested in 1973."* These quotes from survey reports describe in part the impact of the latest outbreak of southern pine beetle (*Dendroctonus frontalis* Zimm.) on Alabama forests. Such economic evaluations generally focus on the commercial forest. However, southern pine beetles will attack all species of native southern pines, and often infest valuable trees in residential areas and parks, especially during outbreak periods. Large trees killed in these situations cannot be replaced, and losses cannot be fully assessed in commercial forest terms.

The southern pine beetle as a pest of commercial forests has received considerable attention in the past, and is currently being studied by various federal and state agencies, including Auburn University Agricultural Experiment Station. Knowledge gained to date provides information helpful in recognizing beetle activity and in developing guidelines for prevention and control of infestations in urban forest areas.

The adult is a cylindrical, reddish-brown to black beetle about ⅛ in. long (Fig. 1). A small median groove in the front of the head (conspicuous in males) is a useful identifying characteristic. Larvae and pupae are correspondingly small. The larva is a legless cream-white grub with a reddish-brown head; the pupa is white. The tiny eggs are oval and pearly white.

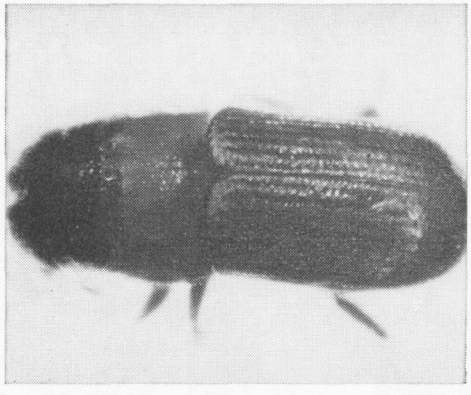


FIG. 1. Southern pine beetle adult (male).

In endemic years when beetle populations are low, infestations are generally confined to scattered weakened or damaged trees. However, under favorable conditions, populations increase rapidly to outbreak proportions, and large areas of apparently healthy trees are attacked.

Attacking adults bore through the outer bark and construct winding S-shaped egg tunnels or galleries, characteristic of this species, in the inner bark (Fig. 2). Eggs are laid singly in niches at intervals along each side of the gallery. Larvae tunnel away from the main gallery excavating short individual galleries in the inner bark. Pupation takes place in a small cell at the end of each larval gallery. Newly formed adults emerge through the outer bark leaving numerous "bird shot-size" exit holes. The life cycle is completed in about 30 days and four to six generations may occur per year in Alabama.

Southern pine beetle activity begins in spring (late March to late April in the Auburn vicinity) and continues into September. The beetle overwinters in all stages of development in the inner bark of host trees. The first evidence of infestation often noted is the change in coloration of tree foliage. Needles of infested trees first turn yellow then reddish brown. In summer, color change may be evident within 2 to 3 weeks following attack. Crowns of overwintering trees attacked in late summer and fall may remain green until late winter or early spring. Further evidence of infestation is the presence of numerous small whitish globules of resin (pitch tubes) about ¼ in. in diameter, on the bark at points of beetle entry (Fig. 3). These are generally characteristic of southern pine beetle attack and may be scattered along the trunk from a few feet above ground level up to the lower crown.

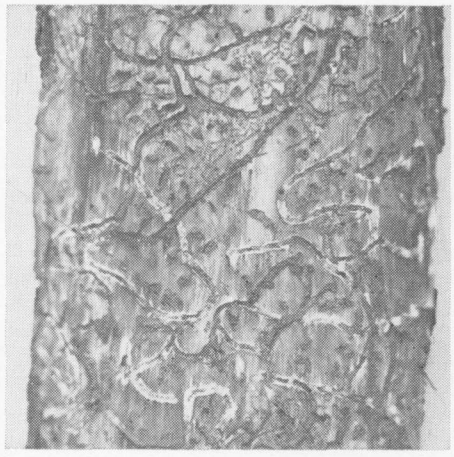


FIG. 2. Galleries of southern pine beetle in inner bark.

Pines weakened and under stress are highly susceptible to attack by southern pine beetle and other pine bark beetles. Trees in populated and high use areas are often in such condition due to injury in construction of homes, roads, streets, sidewalks, public utility lines, and general area use by man. To reduce the chances of development of beetle infestations, trees should be kept in a vigorous and uninjured condition. Some guidelines to follow are: if practical, supply water to valuable trees during drought periods; avoid injury to trunks and root systems in construction of homes, roads, etc.; minimize the use of heavy equipment near trees in maintenance of parks and recreation areas; keep pruning of green limbs to a minimum, but if pruning is necessary, do only in winter months, and avoid the use of standard pole climbers on trunks of green trees; as a general practice, make routine inspections for signs of beetle attack.

FIG. 3. Pitch tubes on bark at points of beetle entry.

Infestation by any one of several species of pine bark beetles may produce symptoms in trees somewhat similar to those caused by southern pine beetle. When symptoms of beetle attack appear, ascertain the primary species responsible. If southern pine beetle is involved, inspect the area carefully, determine the extent of the infestation, and cut all infested trees promptly. All felled material should then be promptly removed from the premises or the brood under the bark destroyed. Broods may be destroyed by burning, if practical, or spraying infested material with 0.5% lindane in fuel oil. All log surfaces should be sprayed to point of runoff. Fuel oil will injure foliage of many plants and water should be substituted for oil in the spray or injury of nearby ornamental plants is likely to be a problem.

ALTERNATIVE LEASE OPTIONS for FARMERS

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FARM TENANCY in 1975 is attracting attention of Alabama farmers as it did in 1925. Leases today vary little from those years back; yet farming today bears little resemblance to farming in 1925.

Only a small proportion of farm operators utilize a full share-tenant arrangement today. The full-owner-operator class of farmers is the largest tenure group. However, few people realize that the majority of farm products are produced under a management system involving some sort of land lease arangement.

Alabama farmers generally have limited knowledge of the effects leasing has on net farm income. This includes operators using the more popular cash lease or the traditional share arrangements. Farm problems of recent years which stem from crop and livestock prices may also extend to the contracts under which land use is achieved. For example, in 1974 many farmers may have paid cash rents for land use which exceeded net income per acre. These types of rental contracts are fixed instruments which allow little or no rent variation from year to year. Traditional crop share contracts allow for more sharing of poor prices between landlords and tenants. However, equity disadvantages to tenants may override gains from sharing.

Is there a better alternative for leasing? Can cash rents be adjusted to allow for price and yield variations? Many share-lease landlords say they have already achieved this adjustment by accepting the cash value of their crop share rather than the commodity. In part, this is correct. If cash rents are adjusted for price and yield variations, a quasi-share rent arrangement results.

Differences in traditional share leases, cash leases, and a procedure for adjusting cash leases are being examined by the Auburn University Agricultural Experiment Station. Data for the tests are from actual farm production activities on the Auburn University owned Gilbert Farm. This unit is being rented to a commercial farmer under a proposal to examine effects of alternative lease arrangements on farm income, production efficiency, and capital equity.

During the first 5 years of the project actual rental arrangements were cash agreements. However, three alternative cash plans were tested. Additional alternatives, such as various share plans, were simulated using actual farm data and traditional lease terms. During the first 2 years of operation under review, a 1-year simple cash plan was used. This plan was followed by a 5-year comprehensive contract based extensively on prevailing government cotton and feed grain programs. After 3 years of this plan, changes in government programs required adjustments in the contract. Thus, a variable cash rent plan based on previous yields and rents and current farm prices was initiated.

Results of the various alternatives thus far show that on the average farm landlords and tenants receive more net income under an equitable cash plan than under traditional crop-share plans. Traditional livestock-share plans, which actually are 50-50 partnerships, showed no income disparity to either party. Income disparities under simulated crop-share conditions were rather heavily biased toward landlords.

The most important element under all alternatives seemed to be the security offered tenants under a long-term (5-year) plan. In conjunction with a 5-year lease, a program was initiated to reimburse the tenant for the undepreciated value of any investments made during his tenure, but remaining at the termination of the contract.

Without the certainty of time and undepreciated investment recovery, resource exploitation by both tenant and landlord would be common. In fact, extensive data on numerous farms under 1-year cash or traditional share leases confirm this fact. Liming, terracing, cover crops, etc. are frequently avoided to reduce costs in the short-run. Obviously the long-run implication of such action is an income reduction.

A new lease alternative was employed in 1974 and 1975 based on price and yield variations. The extreme cotton price fluctuations of recent years caused concern about a fixed cash price each year. The current plan is as follows:

The leasee agrees to pay cash rent on land in cotton using the formula.[1]

Average rent paid per acre of land during a 3-year moving base period ÷ average cotton lint price per pound during the same period × price of lint per pound on November 15 of the respective crop year.

$$\frac{\text{Average rent base period}}{\text{Average lint price for base period}} = \text{pounds of lint charges as rent per acre in following year}$$

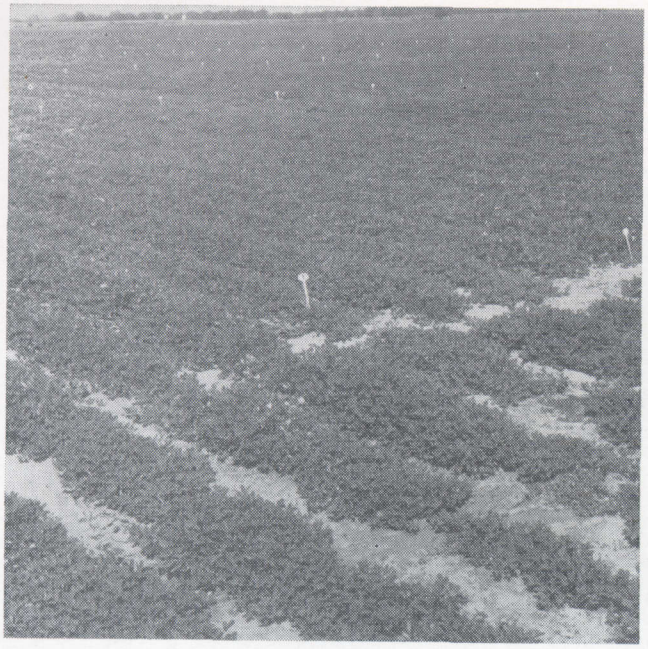
Pounds of lint charged as rent × market price November 15 = cash rent per acre.

This system has the advantage of adjustments for price changes. Also, landlords and tenants share in the crop. Thus, a partial return to sharing is achieved, but without traditional encumbrances.

Disadvantages include problems associated with an absence of historical cash rents and possibly some rental instability during the first 2 or 3 lease years. However, setting maximum and minimum rents can resolve these problems.

Results of the variable cash plan are not conclusive, yet promise of a more equitable plan is evident. In any farm situation operators and landlords should be alert to new procedures which will increase equity, efficiency, and income to both parties. Perhaps this plan can do that for some farms.

[1] Similar plans may be developed for other crops. Also details on base years and cotton grade must be specified.



Experimental plots of peanut disease research at the Wiregrass Substation.

CONTROL of CYLINDROCLADIUM BLACK ROT of PEANUTS in Alabama

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CYLINDROCLADIUM BLACK ROT (CBR) is a relatively new disease of peanuts caused by the soil-borne fungus *Cylindrocladium crotalariae*.

This insidious disease has spread steadily throughout the peanut-growing area of the Eastern States for the past decade. At present it causes substantial yield losses to growers in Virginia and North Carolina. In the field, CBR is readily recognizable by an initial pale discoloration of leaves in affected plants, which also have a wilted appearance and numerous, brick-red, small, spore-producing structures on pegs, pods, and stems at or near the soil line. Roots and pegs develop a black rot that results in death of the plant. CBR was first identified in Alabama in 1972 in peanut fields at the Wiregrass Substation near Headland.

Since no method of control for this disease is known, experiments were conducted at the Substation during the 1973 and 1974 seasons to evaluate various soil treatments for control. Plots of four 33-ft. rows were established in areas heavily infested with the pathogen. Applications were made 3 weeks before planting, at planting, and at blooming time. Each treatment was replicated seven times and plots were arranged in a completely randomized block design. Data on disease incidence were collected 1 week before harvest by counting the number of row lengths (1 ft. or less) that were affected by the disease. Yield data were obtained from two center rows in each plot; these data could not be obtained in 1973 because of adverse weather conditions.

Two broadspectrum materials, sodium azide and Vapam, see table, resulted in significant reductions in disease and increases in yield, whereas the fungicides Terraclor, Terraclor-Super X, Demosan, and nematicides DBCP and Furadan failed to reduce disease or increase yield. Combinations of preplant and post-emergence applications of sodium azide gave the highest reduction in disease. In 1974, sodium azide was the only material that resulted in significantly higher yields than the control when it was applied preplant at rates higher than 36 lb. per acre and when preplant and post-emergence applications were combined.

Our results indicate that few materials are effective in reducing CBR on peanuts. The only treatment with potential for control of CBR was sodium azide in a single post-emergence application at 12 lb. active per acre or possibly this treatment combined with a preplant application at rates below those used in these experiments.

EFFECT OF SOIL TREATMENTS ON THE INCIDENCE OF CYLINDROCLADIUM BLACK ROT IN FLORUNNER PEANUTS DURING THE 1973 AND 1974 SEASON

Treatment	Rate per acre			Disease incidence			Yield/ acre
	Preplant	Plant	Post	1973	1974	Mean	
	Lb.	*Lb.*	*Lb.*	*No.*	*No.*	*No.*	*Lb.*
Control				3.3	4.0	3.6	3,756
Sodium azide	36	0	0	2.1	2.1	2.1	4,121
Sodium azide	48	0	0	---	3.3	3.3	4,328**
Sodium azide	60	0	0	1.3	2.7	2.0	4,304**
Sodium azide	36	0	12	0.50**	2.6	1.5	4,308**
Sodium azide	48	0	12	---	1.6*	1.6	4,242**
Sodium azide	60	0	12	0.3**	---	0.3	------
Sodium azide	0	0	12	1.0*	2.7	1.8	4,072
Vapam	38 gal.	0	0	1.1*	3.0	2.1	4,114

Figures represent averages of 7 plots and those with asterisks were significantly different from the control in the same column.

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